

REMARKS

Applicants have reviewed the Office Action issued by the Examiner on June 1, 2001 and respectfully disagree that the claims are not patentable over the cited prior art. For the reasons set forth below, Applicants believe that claims 1-9 should be allowed.

The present invention is directed to solder spheres made of soft metals, such as lead and tin that have a substantially uniform coating of a lubricant on their surfaces. The coated solder spheres have improved slip properties, which result in the solder balls being resistant to being nicked and scratched and, therefore, also resistant to being oxidized or taking on a blackened appearance.

Claims 1-9 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,885,369 to Hanawa et al. The Examiner asserts that the Hanawa et al. patent discloses the presently claimed invention. Applicants respectfully disagree.

The Hanawa et al. patent discloses a method of inhibiting oxidation of the surface of solder particles used in reflow soldering processes. The objective of the Hanawa et al. patent is to react vaporized adipic acid to the surface of the solder powder resulting in a surface of an organometallic compound composed of adipic acid and a metal of the solder alloy. Thus, adipic acid chemically combines with the surface of the solder particles. The particles are spherical or an irregular shape of 10-100 μ and are added to a flux to prepare a solder paste.

The present invention is directed to a solder ball, i.e., a large spherical solder or ball-shaped solder, which is used as a single ball used with a chip to a BGA or CSP circuit board. The ball solder must be of spherical shape with a size of about 300-2,000 μ . When a solder ball is applied to a circuit board, it rolls down to its place on a circuit board to form a solder joint by itself. Thus, the physical and chemical properties of each of the solder balls are critical to the properties of the solder joints.

Further, solder balls are supplied to users packed in glass or plastic bottles. Such

bottled solder balls are transported for a long distance, in a motor vehicle for example. The round solder balls tend to roll within the bottle and contact each other resulting in wear and the formation of scratches on the solder balls. Eventually, the damaged solder balls lose their metallic luster and blacken and no longer have a smooth surface.

When the damaged solder balls and oxidized dust are applied to a circuit board, the surface of the solder ball is not smooth and round. When the damaged solder ball rolls, vacancies in the solder bumps for solder balls on circuit boards result. This situation leads to the formation of unsoldered connections.

The Hanawa et al. patent attempts to prevent surface oxidation of solder balls, but does nothing to prevent the nicking and scratching of solder balls during transportation.

The present invention is directed to a method of preventing solder balls from being worn or scratched during transportation. Thus, according to the present invention, this property is accomplished by coating solder balls with a chemical as a lubricant, not as a barrier against oxidation.

The Hanawa et al. patent discloses reacting vaporized adipic acid with the surface of solder particles. The present claims are directed to coating solder spheres. The reaction of the Hanawa et al. patent results in adipic acid chemically bonded with the surface of the solder particle. No such reaction is accomplished in the present method. Therefore, it cannot be asserted that the Hanawa et al. patent discloses the present invention and the rejection under 35 U.S.C. § 102(b) should be withdrawn.

Further, the Hanawa et al. patent teaches away from the present invention. At col. 3, lines 40-48, the Hanawa et al. patent recites:


[T]he organic substance which merely adheres to the surface of the particles of the solder powder is dissolved away into the organic solvent and cannot function to prevent the oxidation of the particle surface. Therefore, the organic substance is required to combine chemically with the alloying components of the solder alloy and the resultant organometallic compound is required to be present on the entire surface of the solder particle.

Thus, the Hanawa et al. patent teaches that a solder protectant must be chemically bonded to the solder surface to be effective. In the present invention a lubricant coats the surface of the solder spheres. The Examiner cannot assert an obviousness rejection based on the Hanawa et al. patent because it teaches away from the present invention. Simply coating a solder ball, as in the present invention, is completely at odds with the necessity of reacting adipic acid in vapor form with solder particles as required by the Hanawa et al. patent, and an obviousness rejection cannot be supported based on the Hanawa et al. patent.

Accordingly, in view of the foregoing remarks, it is believed that the present application is in condition for allowance. The Examiner's favorable action is respectfully requested.

Respectfully submitted,

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